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INFLATION UNCERTAINTY AND A TEST OF THE FRIEDMAN HYPOTHESIS*

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This paper tests Friedman's (1977) hypothesis that increases in inflation uncertainty, ceteris paribus, may yield higher levels of unemployment. Tests are made using quarterly measures of inflation uncertainty taken from the ASA-NBER survey. Using the 1972-1984 period, we find general support for the hypothesis.

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I. Introduction

Since the appearance of Friedman's (1977) Nobel lecture, researchers have tested his contention that increased uncertainty about future inflation leads to higher rates of unemployment and lower levels of output. Although the approach to investigating Friedman's hypothesis has varied, the measure of inflation uncertainty used in nearly every study is the standard deviation of the individual responses to the Livingston semi-annual survey.

Our purpose in this paper is to re-examine Friedman's hypothesis using data on inflation expectations and uncertainty taken from the American Statistical Association-National Bureau of Economic Research (ASA-NBER) quarterly survey of professional forecasters. Use of this survey measure, available since IV/1968, allows us to determine the robustness of previous findings to changes in the expectations measures and to changes in the time horizons.

The format of the paper is as follows. The next section gives a brief description of the survey data. Section III presents the models used to test Friedman's hypothesis and the empirical results. Concluding remarks are found in Section IV.

II. The ASA-NBER Survey Data

The ASA-NBER survey is mailed to a list of professional forecasters in the middle month of each quarter.[1/] Conducted continuously since IV/1968, survey respondents are asked to forecast a variety of economic variables. For our purpose, we use the one-quarter forecast of the rate of change of the GNP deflator. This forecast is calculated by using the preliminary estimate of the GNP deflator for the quarter preceding the survey, provided to each survey respondent, as the level from which the growth rate is calculated. Taking the mean value across all respondents' inflation forecasts forms our measure of expected inflation.

To measure inflation uncertainty, we assume that variability in the inflation forecasts can be used to proxy uncertainty. In this context, the standard deviation of the inflation forecasts has been used widely to measure inflation uncertainty.[2/] Because respondents' information sets presumably differ, as would be expected in a Lucas (1973) type economy, information flows vary among forecasters and forecasts of general price movements will be non-uniform. As demonstrated by Cukierman and Wachtel (1982), there may be a close positive relationship between the variability of inflation and the variability of inflation expectations across respondents. Thus, assuming that the survey respondents are representative economic agents, the variation across the individual forecasts may be used to measure the uncertainty with which those expectations are held.

III. Testing Friedman's Hypothesis

To empirically test the notion that increased uncertainty about inflation increases unemployment and reduces output, we first use the approach of Mullineaux (1980).[3/] To test for unemployment effects, Mullineaux uses the model

$$(1)\ U_t = \alpha_0 + \sum_{i=1}^{J} \beta_i U_{t-i} + \delta_0 (p_t - E_{t-1} p_t) + \sum_{i=0}^{K} \emptyset\, \sigma_{t-i} + \varepsilon_t$$

where U is the unemployment rate in period t, p_t is the actual rate of inflation in period t, $E_{t-1}p_t$ is the expectation of inflation for period t, and σ_t is the measure of uncertainty about that expectation. As Mullineaux notes, if $\Sigma\, \emptyset$ is zero, one obtains Sargent's (1976) model used to test a version of the natural rate hypothesis. Under the Friedman hypothesis, the expected sign on $\Sigma\, \emptyset$ is positive.

Equation (1) is cast in a Granger-type framework where lagged values of the dependent variable are included in the estimated equation. Thus, testing for the significance of δ or $\Sigma\, \emptyset$ amounts to determining if these variables increase the explanatory power of the equation when the information contained in past unemployment rates is used.

Equation (1) was estimated using quarterly values for the level of the unemployment rate, measured as the percent of the civilian labor force. The actual rate of inflation is the growth rate of the GNP deflator, the expected inflation rate is the one-quarter ahead mean forecast from the ASA-NBER survey, and the measure of uncertainty is the standard deviation of the forecasts. Based on the I/1972-IV/1984 sample period, the "best" estimate of equation (1) was found to be (t-statistics in parentheses)4/

$$(2)\quad U_t = \underset{(0.99)}{0.303} + \underset{(14.38)}{1.540}\, U_{t-1} - \underset{(5.64)}{0.612}\, U_{t-2}$$

$$- \underset{(-0.01)}{0.003}\, (p_t - E_{t-1}\, p_t) + \underset{(1.92)}{0.127}\, \sigma_t$$

$$\bar{R}^2 = 0.948 \qquad SE = 0.346 \qquad Dh = 0.37$$

Once effects of lagged unemployment have been accounted for, unanticipated inflation has no statistically significant effect on the level of unemployment, a result also found by Mullineaux when the Livingston data were used. More important, the evidence indicates that an increase in inflation uncertainty significantly increases the level of unemployment. Based on the estimated coefficient of 0.127, a one-percentage point increase in the standard deviation of inflation forecasts results in a 0.13 percentage point increase in the level of unemployment. This result supports Friedman's hypothesis.[5/]

Equation (1) also is used to determine if increased inflation uncertainty lowers the level of output. This is done by substituting the level of industrial production (IP) for the unemployment rate. Using this specification the expected sign on $\Sigma\ \emptyset$ is negative. The relevant regression equation for the period I/1972-IV/1984 was found to be[6/]

$$
\begin{aligned}
(3)\ IP_t = {} & \underset{(2.32)}{10.343} + \underset{(11.41)}{1.632}\ IP_{t-1} - \underset{(-4.57)}{1.211}\ IP_{t-2} \\
& + \underset{(2.79)}{0.756}\ IP_{t-3} - \underset{(-1.52)}{0.221}\ IP_{t-4} - \underset{(-0.85)}{0.235}\ (p_t - E_{t-1}\, p_t) \\
& - \underset{(-2.47)}{1.399}\ \sigma_t + \underset{(0.64)}{0.380}\ \sigma_{t-1} - \underset{(-1.81)}{1.028}\ \sigma_{t-2}
\end{aligned}
$$

$\bar{R}^2 = 0.955 \quad SE = 2.849 \quad DW = 1.83$

As with the unemployment result, we find that inflation surprises have no explanatory significance. The summed effect of increased uncertainty about future inflation ($\Sigma = -2.047$) is statistically significant ($t = -2.25$). This result indicates that an increase in inflation uncertainty permanently lowers the level of industrial production.[7/]

Another approach to test Friedman's hypothesis was suggested by Levi and Makin (1981), where a Phillips curve was modified by using the growth of employment as the dependent variable, rather than the level of unemployment. As they note, use of the unemployment rate may introduce misspecification errors since there are various factors that influence the unemployment rate. We alter somewhat Levi and Makin's model and write it in comparable fashion to Mullineaux's. Thus, an employment growth specification of the form

$$(4)\quad \dot{N}_t = \alpha_0 + \beta_1 (p_t - E_{t-1} p_t) + \sum_{i=1}^{K} \lambda_i \dot{N}_{t-i} + \sum_{j=0}^{J} \phi_j \sigma_{t-j} + \varepsilon_t$$

is estimated where $\dot{N}$ is the growth of employment in the nonagricultural sector. In the original Levi-Makin specification, only a contemporaneous σ term appeared, suggesting a permanent, long-run influence on the growth rate. Equation (4), on the other hand, allows us to test for a long-run effect if there is one.[8/]

The results of estimating equation (4) for the I/1972-IV/1984 period are reported in the first column of table 1. The empirical version of equation (4) was found to include 7 lags of employment growth and 8 lags on the inflation uncertainty measure. Inclusion of the inflation uncertainty terms increases the explanatory power of the equation at the 6 percent level. Moreover, the summed coefficient on σ is not statistically different from zero at any reasonable level of significance. Thus, this evidence indicates that inflation uncertainty has a significant, but transitory impact on employment growth. As in the previous test equations, unexpected inflation has no significant effect.

Upon testing for stability, the null hypothesis of stable coefficient estimates was rejected easily: the calculated F-value was 8.60. Consequently, equation (4) was estimated for the I/1972-IV/1978 and I/1979-IV/1984 subperiods. These results are presented in columns 2 and

3, respectively, in table 1. Note, first, that inflation uncertainty has no statistically significant effect during the first period. During the second period, however, the addition of the uncertainty variables is significant at the 2 percent level and the sum coefficient on σ is not statistically different from zero. It also should be noted that during this subperiod, the coefficient on inflation uncertainty achieves statistical significance: unfortunately, it takes the theoretically incorrect negative sign.

IV. Conclusion

We have tested Friedman's (1977) hypothesis that increases in inflation uncertainty lead to higher rates of unemployment, lower levels of output and slower growth in employment. Previous tests have relied primarily on data constructed from the Livingston survey. Our study uses the quarterly inflation forecasts obtained through the ASA-NBER survey of professional forecasters. Using the standard deviation of the survey's one-quarter ahead forecasts as our measure of inflation uncertainty, the evidence presented here generally supports Friedman's contention that increased inflation uncertainty raises the level of unemployment and lowers the level of output. Moreover, tests using employment growth indicate a negative transitory impact, with no long-run effect.

FOOTNOTES

1/ For a general discussion of this data, see Zarnowitz (1969). Recent analyses of the survey inflation forecasts include Zarnowitz (1979, 1983) and Hafer (1985).

2/ Clearly, statistical variability may not capture the level of uncertainty held about the forecast. This aspect of measuring inflation uncertainty remains unresolved, as demonstrated by the use of a variety of measures to proxy inflation uncertainty. For a relevant discussion, see Holland (1984).

3/ Other models and test results are offered in Amihud (1981) and Ratti (1985).

4/ The selection of the lag specification was done using Akaike's (1970) final prediction error criterion (FPE) and a test due to Pagano and Hartley (1981) (PH). Using a maximum lag length of 12 for the unemployment and uncertainty measures, each lag length selection procedure chose two lags on unemployment and only a contemporaneous uncertainty term. Although the inflation uncertainty measure is available since IV/1968, use of 12 lags necessarily shortened the available sample.

5/ Test for stability indicated that one could not reject the hypothesis that the relationship was unchanged. Based on an F-test with a IV/1978 breakpoint, the calculated F-statistic was only 0.65.

6/ Again the appropriate autoregressive lag structure was determined using the FPE and PH techniques. Each chose 4 lags on industrial production, but FPE selected 2 lags on the uncertainty term and PH results suggested 2 or 8 lags. Comparing the model using 8 lags vis-a-vis 2 lags, we found that the additional lags did not increase the explanatory power of the equation.

[7/] Using IV/1978 as the break, we could not reject the hypothesis of coefficient stability. The calculated F-statistic is 1.14. Also, note that we report the Durbin-Watson statistic. This is because we could not calculate Durbin's-h.

[8/] Holland (1985) has argued that a permanent reduction in the growth of employment suggests that the labor market never adjusts to the new environment. Although such an adjustment may take various forms, he presents evidence to suggest that the use of COLA wage adjustments have lowered the effect of inflation uncertainty effects on employment growth.

Table 1
Employment Growth Regression

Equation tested: $\dot{N}_t = \alpha_0 + \beta_1 (p_t - E_{t-1} p_t) + \sum_{i=1}^{K} \lambda_i \dot{N}_{t-i} + \sum_{i=0}^{J} \emptyset_i \sigma_{t-i} + \varepsilon_t$

Coefficient	I/1972-IV/1984	I/1972-IV/1978	I/1979-IV/1984
α_0	1.289(0.61)	-3.138(0.75)	4.216(1.57)
β_1	0.121(0.64)	0.006(0.01)	-0.916(2.49)
λ_1	1.018(6.79)	1.121(4.77)	1.235(4.08)
λ_2	-0.456(2.29)	-0.459(1.32)	-1.952(3.90)
λ_3	0.198(0.97)	0.116(0.31)	1.085(4.03)
λ_4	0.055(0.26)	0.335(0.83)	-0.518(1.63)
λ_5	-0.387(1.90)	-0.605(1.87)	0.308(1.30)
λ_6	0.574(2.73)	0.634(1.96)	0.289(1.44)
λ_7	-0.339(2.15)	-0.235(0.95)	-0.006(0.03)
$\emptyset_0$	-1.034(2.72)	-1.266(1.79)	-0.139(0.21)
$\emptyset_1$	0.374(0.94)	0.651(0.94)	-2.659(3.58)
$\emptyset_2$	-0.346(0.91)	-0.079(0.10)	-0.729(2.01)
$\emptyset_3$	0.001(0.00)	-0.093(0.11)	0.398(1.17)
$\emptyset_4$	0.160(0.41)	-0.035(0.04)	-0.828(1.65)
$\emptyset_5$	-0.017(0.04)	0.488(0.59)	-0.716(1.47)
$\emptyset_6$	0.377(0.98)	-0.156(0.20)	1.300(3.36)
$\emptyset_7$	-0.754(2.08)	0.509(0.58)	-0.409(1.22)
$\emptyset_8$	0.897(2.42)	2.237(2.58)	1.387(3.55)
$\Sigma\emptyset$	-0.340(0.31)	2.256(0.97)	-2.395(1.70)
$\bar{R}^2$	0.617	0.554	0.867
SE	1.789	1.902	0.995
Dh	N.A.	N.A.	N.A.
DW	2.01	2.29	2.65

NOTE: Absolute value of t-statistics appear in parentheses.

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